

**Sector**

Energy Generation and Distribution

**Strategy/Policy**

More Stringent Power Plant Rules

**Methodology and Data Sources for GHG Emission Reduction Calculation**

$$M_n = \sum_{i=2010}^n Z_i$$

$$Z_i = \underbrace{\frac{\overline{E_{2007 \rightarrow 2009}}}{C}}_{\text{GHG emissions from power plant(s) or unit(s) shutting down}} - \underbrace{(\overline{G_{2007 \rightarrow 2009}} \times A)}_{\text{GHG emissions from electricity generation that will occur to supply power, assumed from marginal natural gas power plant(s) or unit(s)}}$$

GHG emissions from power  
plant(s) or unit(s) shutting down

GHG emissions from electricity generation that will occur  
to supply power, assumed from marginal natural gas  
power plant(s) or unit(s)

where:

Symbol	Value	Unit	Description	Data Source & Assumption
$M_n$	(calculated)	MMTCO <sub>2</sub> e	CO <sub>2</sub> e mitigated in year n	(see below)
$Z_i$	(depends on year i)	MMTCO <sub>2</sub> e	CO <sub>2</sub> e savings for year i from power plant(s) or unit(s) shutting down, but accounting for electricity that will be generated by assumed marginal natural gas power plants	(see below)
$\overline{E_{2007 \rightarrow 2009}}$	(depends on power plant(s) or unit(s) shutting down)	short ton CO <sub>2</sub>	three year 2007-2009 average of reported CO <sub>2</sub> emissions at the power plant(s) or unit(s) shutting down	Annual CO <sub>2</sub> emissions data as reported to EPA by power plants. Assumed that the 3-year average would buffer annual differences influenced by maintenance schedule variability, weather patterns.
$\overline{G_{2007 \rightarrow 2009}}$	(depends on power plant(s) or unit(s) shutting down)	MWh	three year 2007-2009 average of electricity generated at the power plant(s) or unit(s) shutting down	As reported to MassDEP by power plants. Assumed that the 3-year average would buffer annual differences influenced by maintenance schedule variability, weather patterns, electricity demand, etc.
$A$	0.40435848E-6	MMT CO <sub>2</sub> e/MWh	emission rate for natural gas power plants	Based on natural gas emission rate used in LEAP model in developing the Clean Energy and Climate Plan for 2020.
$C$	1.10231131092439E6	short ton/MMT	conversion factor to convert short tons of CO <sub>2</sub> into million metric tons of CO <sub>2</sub> e (MMTCO <sub>2</sub> e)	Assumed minimal or no significant emission from other gases, besides carbon dioxide (CO <sub>2</sub> ), with global warming potential.

**Sector**

Energy Generation and Distribution

**Strategy/Policy**

Expanded Renewable and Alternative Portfolio Standard

**Methodology and Data Sources for GHG Emission Reduction Calculation**

$$M_n = [R_n - (L_n \times P_n)] \times A \div C$$

Submitted RPS Class 1 RECs beyond the remaining  
baseline energy load after energy efficiency measures

where:

Symbol	Value	Unit	Description	Data Source & Assumption
$M_n$	(calculated)	MMT CO <sub>2</sub> e	CO <sub>2</sub> e mitigated in year n	(see below)
$R_n$	(depends on year n)	MWh	Submitted RPS Class 1 renewable energy credits (RECs) for year n	MA Department of Energy Resources (DOER)
$L_n$	(depends on year n)	MWh	Expected energy load after energy efficiency measures through year n	Based on baseline calculations for the Clean Energy and Climate Plan for 2020. Assumed that energy savings from the All Cost Effective Energy Efficiency strategy/policy are fully realized. The baseline energy load used 2009 ISO-NE CELT Forecast for MA Net Energy Load projections, less pre-Green Communities Act RPS, 14.8% of load delivered by municipal electric companies, and a 7% loss during distribution.
$P_n$	(depends on year n)	%	<a href="#">RPS Class 1 standard</a> before the Green Communities Act of 2008: percentage of electricity from renewable sources for year n	<a href="#">Massachusetts Renewable Energy Portfolio Standards (RPS)</a> requirements before the Green Communities Act of 2008.
$A$	1030	lb CO <sub>2</sub> /MWh	emission factor for electricity savings	2010 New England Average Avoided CO <sub>2</sub> Emissions, average for New England, average for winter & summer ( <a href="#">AESC 2009</a> , Exhibit 6-47).
$C$	2204.62E6	lb/MMT	conversion factor to convert pounds of CO <sub>2</sub> into million metric ton of CO <sub>2</sub> e (MMT CO <sub>2</sub> e)	Assumed minimal or no significant emission from other gases, besides carbon dioxide (CO <sub>2</sub> ), with global warming potential.